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Economic Impact of the Port Industry on the New York-New Jersey Metropolitan Region

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THE PORT AUTHORITY OF NY & NJ

Study Conducted by the Economic Impacts Division, Office of Economic & Policy Analysis

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EXECUTIVE SUMMARY

The Port of New York-New Jersey remains a premier gateway for the nation and a major asset to the region's economy. Although not as visible as it was many years ago when the region's shipping activity was concentrated at the congested city waterfront, the port's operations contribute in many ways to the region's economic health and standard of living.

The impacts generated by the port industry span many sectors of the region's economy. The actual handling of cargo which is concentrated in marine terminals and piers along the waterfront is only a part of the many activities that are linked to the port. Activities that take place on railroad and truck lines, at related inland warehouses and freight forwarding facilities, as well as in downtown offices that handle the daily financing, insurance, and related government services, are all integral aspects of the direct port industry. The purpose of this report is to quantify the linkages between these direct port industry activities and the regional economy and to document the port's economic contributions to the New York-New Jersey metropolitan region.

Major Findings

Analysis, using the Port Authority's Regional Input-Output Model, showed that based on 1993 activity levels (in 1994 dollars), the Port Industry was responsible directly and indirectly for:

- Over $19 billion in regional sales[1]
- 166,500 jobs in the regional economy
- $6.2 billion in regional wages
- Over $0.5 billion in regional income and sales taxes

The impact of the port industry represents a significant portion of the total regional economy. It is estimated that the port industry produced 2.0 percent of Gross Regional Product and 1.3 percent of total regional employment.

Other Contributions to the Regional Economy

Beyond the economic impacts generated by the port industry via its linkages to other industries in the regional economy, the Port of New York-New Jersey is an important asset to this region in other respects:

- The existence of the port is essential for other regional industries that are significantly dependent on direct access to a port and waterborne shipping. These industries, such as scrap and waste materials, petroleum refining and sugar cane refining, employ a total of 17,340 in the region, generating a total payroll of over $0.8 billion, and sales

[1] All dollar figures are reported in 1994 Dollars.

of $7.3 billion. Through the multiplier process, these industries generate 32,310 total jobs, $1.4 billion in wages, and $10.0 billion in regional sales.

- In addition to the impact of the port's current operations, the port must also gear up for future growth and changing technologies which require heavy investment in facility construction and equipment. Expressed in annual terms, capital investments by the Port Authority and tenants in marine facilities, generated a total of 1,412 jobs, $0.053 billion in wages, and $0.148 billion in sales.

- The port is a major component of the regional economy and the regional infrastructure network, and as such, its existence leads to a number of positive effects. These include increased business opportunities and improvements in the regional business environment, improved access to markets, generally lower consumer costs, and transportation benefits such as reduced highway congestion.

Including the impact of the port industry, port dependent industry, and capital spending, the Port of New York-New Jersey stimulated a total of 193,390 jobs, over $28 billion in sales revenues, $7.5 billion in wages, and $0.6 billion in state and local taxes in the 17-county metropolitan region. These port industry impacts represent a significant contribution to the regional economy, accounting for 3.3 percent of the Gross Regional Product and also generating about 1.6 percent of regional employment.

SECTION 1: INTRODUCTION

The New York-New Jersey metropolitan region's preeminence in international trade and commerce stems from the activity of its port. Beginning with European settlement of the region, and for many decades thereafter, the arrival of a ship in port was a great occasion. In those simple times, everyone knew that ship arrivals benefitted the community, by providing new stock for merchants' shelves, activity and jobs at marine terminals and business for exporters and importers.

Then, as now, the unloading, and storage of cargo, provided numerous employment opportunities. Back then, much of the region's shipping activity was concentrated at the congested city waterfront. With the advent of containerization, this activity shifted to more spacious, less populated, areas. Consequently, the port has become less visible, and unlike the activities of the region's airports which are directly observed by millions of travellers every year, the region's waterborne trade was removed from the mainstream of everyday experience. Even though the port's contributions to the New York-New Jersey metropolitan region are not as apparent as they were in earlier periods, the industry remains a vital component of the region's economic base.

The purpose of this report is to quantify the linkages between the port and the regional economy and to document its economic contributions to the New York-New Jersey metropolitan region. It is the third in a series of reports documenting the economic impact of the port industry on the regional economy. While the study was designed to be comparable to the earlier 1987 study in terms of data collection and analysis, its scope is different. In addition to the economic impact of the port industry, this study presents the economic impact of port-dependent industries and capital expenditures made by the Port Authority and its tenants in port facilities.[2] It also explores certain qualitative aspects of the cost and benefits of the regional port system. The report focuses on data for 1993 and is not a chronological study of the industry. All economic impact results are reported in 1994 dollars.

The report is divided into seven main sections. This introduction sets forth the background and purpose of the report, defines the port industry and develops conceptual linkages to the regional economy. Section two discusses the components of the port industry. Section three presents the results of the economic impact analysis which quantify the port industry's many contributions to the region. The fourth section presents the economic impact of port-dependent industries. Section five presents the economic impact of port investment by both the Port Authority and port tenants, and section six is a summary of all impacts of the port industry. The final section looks at additional non-quantified benefits of the port, and takes a look at associated costs.

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2 Capital expenditures made by the port-dependent industries are not included in this study.

Definition of the Port Industry

The port industry is defined as any regional economic activity that is directly needed for the movement of waterborne cargo. This includes not only land and waterside activities, but also documentation, financing, brokering and other essential services that are directly required for the movement of each ton of cargo. In addition, services that are performed in this region which are directly related to the physical movement of waterborne trade through other ports are included as an integral part of the port industry.

Specifically, the industry has been defined as firms which:

- Provide products and services involved in the transportation of cargo through all terminals of the Port of New York-New Jersey and between the Port and an inland destination/origin.

- Provide major products and services directly required for the conduct of international trade, to companies which transport cargo through the Port of New York-New Jersey.

- Provide warehousing and distribution services for cargo shipped through the Port.

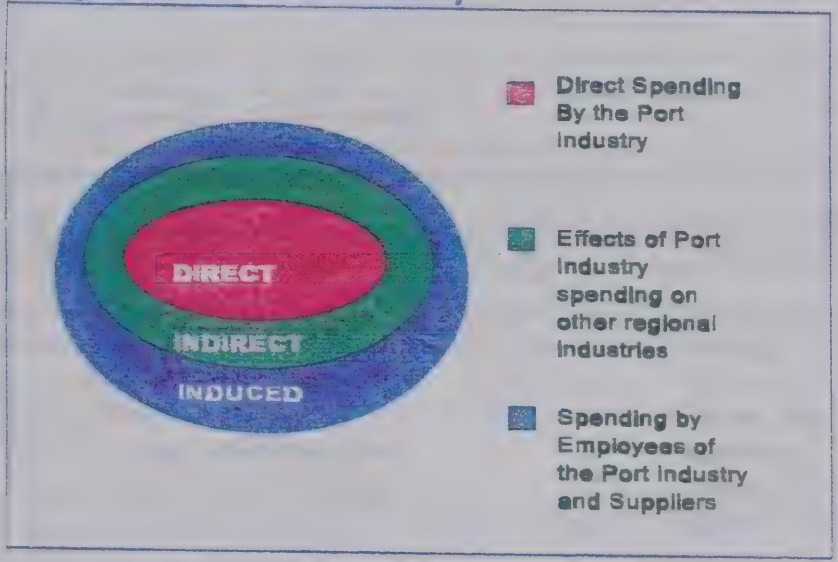
- Directly provide ocean transportation, local water transportation or trade related services for cargo moving through ports other than the Port of New York-New Jersey.

- Passenger carrying vessels and firms providing services for passengers are not included as a part of this analysis.

The activities of firms which provide support services to the port industry (i.e., ship repair, chandlers, truck repair, automotive insurance), are not included as direct impacts; however, the activities of these firms make up a large component of the indirect impact of the industry.

The economic activities of the port industry are linked to other industries in the regional economy. Port activities which take place at the waterfront, on board vessels, on railroad and truck lines, at related inland warehouses and freight forwarding facilities, as well as in downtown offices that handle the daily financing, insurance, brokerage and other direct needs of the industry, generate indirect and induced economic effects in the regional economy. Regional impacts occur when these companies which are directly engaged in maritime commerce purchase goods and services such a ship maintenance, repair services and fuel from other regional firms. These purchases lead to further inter-industry activity, the impact of which is called the indirect impact. Additionally, induced impacts occur when workers involved in direct and indirect activities spend their wages in the region. The ratio between total economic and direct impact is termed, the multiplier. The framework in Chart 1 above illustrates these linkages.

Chart 1
Multiplier Effect of the Port Industry


DIRECT
INDIRECT
INDUCED
Direct Spending By the Port Industry
Effects of Port Industry spending on other regional industries
Spending by Employees of the Port Industry and Suppliers

SECTION II: ECONOMIC IMPACT OF THE PORT INDUSTRY

This section will present the results of the economic impact study of the port industry in a number of different ways. First, the total direct, indirect and induced impacts will be examined. This will be followed by a discussion of impacts by handling mode. Next a breakdown of impacts by direction and trade (foreign vs. domestic) will be presented. All results are based on 1993 activity levels and are reported in 1994 dollars. Totals may not add due to rounding.

Economic Impact of the Port Industry

The direct impacts reported below include the activities of firms directly related to the movement of waterborne cargo. These include the jobs of people who perform the work, their wages, sales directly related to services involved in the movement of cargo by water, and related government activities. Direct impacts were determined for each of 13 specific industry sectors:

- Ocean Transportation
- Marine Cargo Handling
- Local Water Transportation
- Other Support Services
- Trucking and Warehousing
- Inland Rail Transportation
- Movement of Cargo by Pipelines
- Wholesaling
- Banking
- Insurance
- Freight Forwarding/Customs House Brokerage
- Federal Government
- State and Local Government

In addition to the direct impacts, the Port Authority's Regional Input/Output model, along with the methodology described in detail in Appendix 1, was used to estimate the indirect and induced economic impacts of the port industry on the NY/NJ 17-county metropolitan region.

In sum, the port industry was responsible for the following regional economic impacts in 1993:

- Total direct, indirect and induced regional sales of over $19.0 billion.
- 166,500 jobs in the region and $6.2 billion in wages.
- Regional income and sales taxes[3] of over $0.5 billion.

[3] Tax revenues for the states of New York and New Jersey and the City of New York.

The impact of the port industry represents a significant portion of the total regional economy. It is estimated that the port industry produced 2.0 percent of Gross Regional Product and 1.3 percent of total regional employment in 1993.

Direct Activity

Of the 166,500 jobs generated by the port industry, 55 percent, or 92,320 were direct jobs. These jobs represent actual employment that can be counted or directly linked to cargo activity. Direct jobs were measured for the 13 sectors according to the methodology presented in Appendix 1. Of the total direct employment, 20 percent was due to marine cargo transportation and handling activities and 15 percent to the inland transportation of cargo. Another 43 percent of the total jobs were in the warehousing and wholesaling sectors, 20 percent in trade related services and 2 percent were government jobs. Table 1, on page 6, lists direct employment impacts by sector.

All of the direct impacts of the port industry are driven by the cargo moving through the regional port system. Shippers moved over 116.7 million metric tons of cargo through the regional port system in 1993 valued at approximately $9.4 billion.[4]

Indirect and Induced Impacts

The economic activities of the port industry are linked to those of other industries in the regional economy. The Port Authority Input/Output Model is used to identify the economic effects of direct port activities throughout the regional economy. These effects include the indirect impacts resulting from the expenditures by industries that supply materials and services to the port industry and the induced impacts generated by the expenditures of wage earners involved in both direct and indirect activities. Table 2, on page 7, lists a number of economic sectors with indirect and induced impacts. All told, the indirect and induced effects of the port industry accounted for more than $8 billion in regional sales. These sales produced 74,180 jobs with over $2 billion in wages. These jobs represented 45 percent of the employment generated by the port industry.

[4] All dollar values are in 1994 dollars.

Table 1
Direct Employment in the Port Industry by Sector

SECTOR	DIRECT JOBS	PERCENT
Marine Cargo Transportation and Handling		
Ocean Transportation	10,579	11.46%
Marine Cargo Handling	5,831	6.32%
Local Water Transportation	1,200	1.30%
Other Support Services	883	0.96%
Subtotal	18,493	20.03%
Inland Transportation Activities		
Trucking	11,420	12.37%
Rail Transportation	2,240	2.43%
Pipelines	7	0.01%
Subtotal	13,667	14.80%
Wholesaling and Warehousing Activities	40,000	43.33%
Trade Related Services		
Banking	7,230	7.83%
Insurance	1,164	1.26%
Freight Forwarding and Customs House Brokerage	9,723	10.53%
Subtotal	18,117	19.62%
Government		
U.S. Customs Service	1,000	1.08%
Other Federal Government	331	0.36%
Port Authority of New York/New Jersey	565	0.61%
Other State and Local Government	147	0.16%
Subtotal	2,043	2.21%
Total	92,320	100.00%

It is interesting to note how many different industries indirectly benefit from the sales of firms involved in moving waterborne cargo. Overall, firms in over 470 economic sectors can attribute at least a small portion of their total sales to the port industry. Most of these firms are involved in

business support and service activities, however; over $0.7 billion in regional manufacturing sales resulted from the port industry in 1993. In sum, almost 4,700 regional manufacturing jobs are indirectly linked to the port industry. Not only are longshore jobs affected when the port prospers, but so are the jobs of metalworkers, textile workers, commercial printing workers, and plastics manufacturing workers. In fact, the port industry touches almost every single sector in the region's economy.

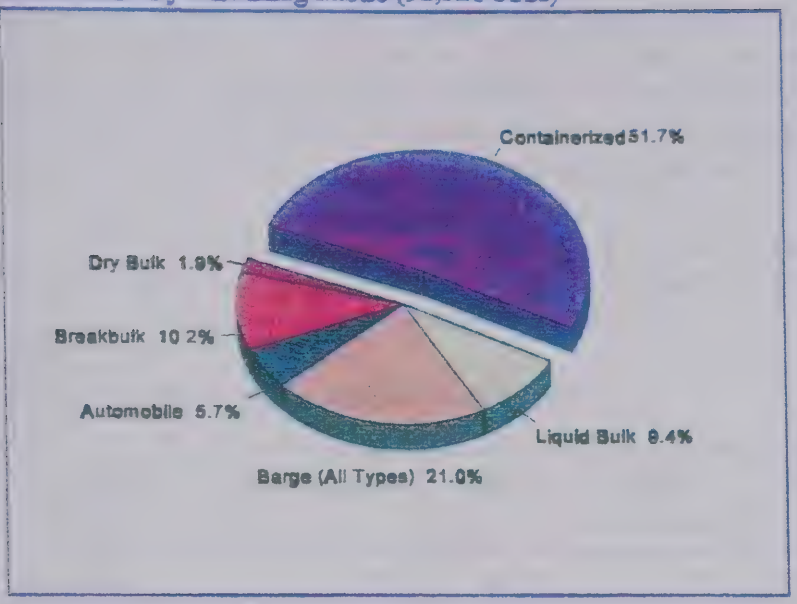
Table 2
Major Indirect and Induced Impacts of the Port Industry

SECTOR	EMPLOYMENT	SALES (Million $ 1994)
Other Transportation	12,098	2,069
Wholesale & Retail Trade	12,096	805
Business Services	11,573	1,163
Real Estate	9,546	1,083
Eating & Drinking Places	6,528	275
Medical & Educational Services	5,473	415
Personal Repair Services & Hotels	4,862	355
Communications	2,970	491
Printing & Publishing	1,854	220
Government	1,723	168
Utilities	1,555	540
Truck & Auto Repair Services	1,373	143
Amusements	504	72
Shipbuilding & Repair	169	14
Food & Kindred Products	139	22
Apparel Manufacture	49	5
Other	1,668	225
Total Indirect and Induced Impacts	74,180	8,065

Economic Impact by Cargo Handling Mode

The total impacts calculated above are based on aggregate cargo handled through the region's port facilities including both general and bulk cargoes. General cargo include containerized cargo, breakbulk cargo and automobiles. Containerized cargo are commodities that arrive at the terminal

Chart 2
Direct Jobs By Handling Mode (92,320 Jobs)



in individual units and are then packed into containers, e.g., clothing, plastics, footwear, and electrical machinery. Breakbulk cargo are commodities that are handled in individual units not packed in containers, e.g., heavy machinery, lumber, steel and iron. Bulk cargo consists of free flowing, either dry or liquid commodities, moving in large homogenous loads, e.g., grain, sand, gravel, cement, and petroleum.

The regional port complex handled a total of 116.7 million metric tons of cargo in 1993, of which 14.4 million tons, or 12.3 percent, consisted of general cargo, and 102.3 million tons (almost 88 percent) was bulk. Table 3 below lists cargo moved through the port in 1993 by handling type.

Table 3
Cargo Handled in the Region by Handling Mode (1993)

Handling Mode	Cargo Volume (Thousand Metric Tons)	Percent	Cargo Value (Million $ 1994)	Percent
Containerized	11,055	9.47%	47,400	50.29%
Breakbulk	2,591	2.22%	9,698	10.29%
Automobile	759	0.65%	7,970	8.46%
Subtotal - General Cargo	14,405	12.34%	65,068	69.04%
Dry Bulk	3,574	3.06%	1,010	1.07%
Liquid Bulk	24,897	21.33%	5,610	5.95%
Barge (All Types)	73,867	63.27%	22,560	23.94%
Subtotal - Bulk Cargo	102,338	87.66%	29,180	30.96%
Total Cargo	116,743	100.00%	94,248	100.00%

The movement of general cargo, on average, has a greater impact on the regional economy than does bulk cargo. For example, containerized cargo, which accounted for only 9.5 percent of the total by weight directly contributed 47,760 jobs to the region, verses 29,870 for all bulk cargoes combined. Overall, general cargo accounted for 67.6 percent of the direct employment impact of the port industry, with containerized cargo contributing the largest share of this. Breakbulk cargo generated just 9,380 jobs, (10.2 percent) and motor vehicles produced 5,310 jobs or 5.7 percent.

The largest of the bulk categories was barge cargo (mostly domestic in nature) which generated 19,420 jobs. Table 4 lists all of the direct impacts of the port industry by handling mode.

Table 4
Direct Economic Impact by Handling Mode

Handling Mode	Employment	Pct.	Wages ($ Million)	Pct.	Sales ($ Million)	Pct.
Containerized	47,760	51.73%	1,955	51.77%	5,650	51.69%
Breakbulk	9,380	10.16%	382	10.12%	1,160	10.61%
Automobile	5,310	5.75%	216	5.72%	622	5.69%
Dry Bulk	1,730	1.87%	70	1.85%	229	2.10%
Liquid Bulk	8,720	9.45%	368	9.75%	1,196	10.94%
Barge (All Types)	19,420	21.04%	785	20.79%	2,073	18.97%
All Cargo	92,320	100.00%	3,776	100.00%	10,930	100.00%

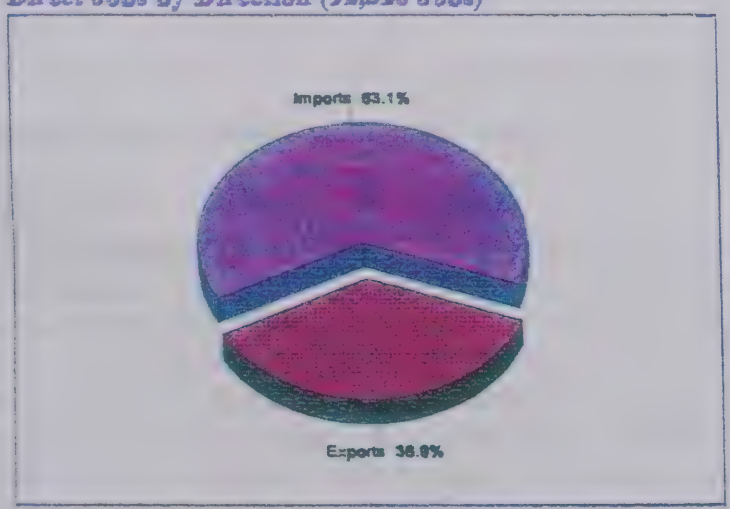
Economic Impact by Direction

Trade within the Port of New York-New Jersey was not balanced, particularly in the international trades. In terms of volume, international imports outweighed exports by 5 to 1 (the ratio for general cargo trade is 1.5 to 1.) Exports, however, tend to be more valuable than imports with the divergence between the two being reduced to only 2 to 1 in value terms. Volumes of domestic cargo, on the other hand, are more balanced, with exports slightly outweighing imports. These differences between the directional components of foreign and domestic cargo tend to balance each other, leading to a 60/40 split between imports and exports for the harbor as a whole. Table 5, on page 10, presents cargo handled in the region by import and export.

Table 5
Cargo Handled in the Region by Direction (1993)[5]

Direction	Cargo Volume (Thousand Metric Tons)	Percent	Cargo Value (Million $ 1994)	Percent
Import				
Domestic	36.510	31.27%	12.998	13.79%
International	33.179	28.42%	39.350	41.75%
Subtotal - Import	69.689	59.69%	52.348	55.54%
Export				
Domestic	40.499	34.69%	23.842	25.30%
International	6.555	5.61%	18.058	19.16%
Subtotal - Export	47.054	40.31%	41,900	44.46%
Total Cargo	116,743	100.00%	94.248	100.00%

Chart 3
Direct Jobs by Direction (92,320 Jobs)



The economic impact of the port industry tends to reflect both the value of cargo handled as well as volumes. In terms of jobs, the economic impact of import cargo is about 58,300, (63 percent) compared with 34,000 for exports (37 percent). This basically mirrors the 60/40 percent tonnage split. This does not, however, directly lead to the conclusion that the tonnage of cargo handled is more important than value in terms of job development, but rather reflects the high proportion of domestic export cargo, most of which is handled by barge (see foreign vs. domestic below).

[5] Note that domestic cargo traveling outbound is classified as an export, inbound cargo as an import. Interharbor cargo traveling downbound (toward the sea) is classified as an export, upbound (away from the sea) as an import.

The differences between the makeup of import and export cargoes lead to differences in the makeup of their relative economic impacts. Of the total jobs attributed to export cargo, 18 percent are due to inland transportation, 20 percent from water transportation and cargo handling, 38 percent for wholesaling and warehousing, 22 percent for trade related services and 2 percent for government. Jobs for import cargo differ in that only 13 percent are related to inland transportation, 18 percent for trade related services, and a full 46 percent are for wholesaling and distribution. This is because a higher proportion of import cargo goes through the distribution channel than exports. Table 6 lists total impacts by direction.

Table 6
Direct Economic Impact by Direction

Direction	Employment	Pct.	Wages ($ Million)	Pct.	Sales ($ Million)	Pct.
Import	58,280	63.13%	2,386	63.19%	6,926	63.37%
Export	34,040	36.87%	1,390	36.81%	4,004	36.63%
All Cargo	92,320	100.00%	3,776	100.00%	10,930	100.00%

Economic Impact: Foreign vs. Domestic Cargo

Even though the Port of New York-New Jersey is one of the nation's leading ports for foreign trade, the majority of the volume handled in the region is domestic cargo. Most of this trade consists of the movement of petroleum and petroleum based products from refineries to other points in the harbor, or the movement of construction materials and garbage throughout the region by barge. Another important component of the domestic trade is cargo movements between mainland United States, and overseas territories such as Puerto Rico and the US Virgin Islands. A smaller, though important, part of the domestic trade consists of the intercoastal transportation of containerized cargo and petroleum products between New York and other Atlantic coast ports.

Table 7, on page 12, shows the breakdown of cargo handled in the region by domestic vs. international trade. Domestic cargo accounts for almost 66 percent of the total because it consists mostly of bulk items such as petroleum, sand and garbage. International cargo, on the other hand, contains a higher percentage of high value items such as automobiles and containerized consumer products, therefore, it accounts for the majority of the cargo value.

Table 7
Foreign vs. Domestic Cargo Handled in the Region (1993)[6]

Trade	Cargo Volume (Thousand Metric Tons)	Percent	Cargo Value (Million $ 1994)	Percent
Domestic	77,009	65.96%	36,840	39.09%
International	39,734	34.04%	57,408	60.91%
Total Cargo	116,743	100.00%	94,248	100.00%

As was stated above, in the discussion about imports and exports, economic impacts tend to be driven by both the labor intensive general cargo trades, and by cargo value. Because of this, international cargo accounts for a higher percentage of the direct economic impact (about 66 percent), even though there is far less of it. In employment terms, international cargo generated 59,090 jobs, compared to only 33,230 for the domestic trades. Table 8 lists direct impacts for both trades in employment, wage and sales terms.

Table 8
Direct Economic Impact: Foreign vs. Domestic

Trade	Employment	Pct.	Wages ($ Million)	Pct.	Sales ($ Million)	Pct.
Domestic	33,230	35.99%	1,360	36.02%	3,698	33.83%
International	59,090	64.01%	2,416	63.98%	7,232	66.17%
All Cargo	92,320	100.00%	3,776	100.00%	10,930	100.00%

Comparison of Economic Impacts, 1987 and 1992

Table 9, on page 13, compares the impacts calculated in this analysis with those of the last study of the economic impact of the port industry which used data from 1987. The volume of cargo handled by the regional port industry declined significantly between the two study years. Overall, the volume of international cargo handled over the region's wharves was 24.3 percent less in 1993 than in 1987. This was due mainly to large decreases in imported petroleum products. Companies imported over 39 million metric tons of bulk cargo through the New York Customs District[7] in 1987.

[6] Please note that domestic cargo includes Puerto Rico and Overseas US Territories.

[7] The New York Customs District includes the Port of Albany, New York.

This was down to just 25.7 million metric tons in 1993. This 24 percent decrease was largely due to major reductions in the importation of residual fuel oils, which are used as feedstock for electrical power plants (down by 49 percent or almost 7.6 million tons), and gasoline (off by 63 percent or 6.2 million tons). While bulk petroleum imports were off dramatically, both bulk exports, and general cargo volumes remained relatively flat between 1987 and 1993.

The sizable decrease in bulk cargo imports, along with productivity increases throughout the port, have led to significant reductions in the economic impact of the port industry. Overall economic impact, or sales, were 11.2 percent smaller in real terms. This decrease led directly to the smaller number of jobs in 1993, when compared to 1987. It is important to note that neither economic impact or jobs fell as precipitously as did cargo volumes during this same period. This is due to the fact that liquid bulk cargoes do not create nearly as much economic impact per ton as do products handled either in containers, breakbulk form or even as dry bulk.

Table 9 shows a brief comparison of the job impacts between the 1993 and 1987 study periods. Total jobs in the current period are slightly lower than was the case in 1987. Overall, the port industry generated 14,300 fewer jobs (7.9 percent), in the regional economy than it did just six years ago. Direct jobs were down from 1987 by 14 percent. Some of this decrease is due to the fall in petroleum imports; however, much of it is due to changes that have occurred in both the industry and the regional economy.

Jobs in the physical handling segment of the industry have declined by 24.4 percent. This large decrease is due primarily to losses in ocean transportation headquarter jobs and continued consolidation in the industry, continued attrition among longshoremen, the tugboat strike of 1989, and the recession of 1989-1992 which led to reductions in local water and other support activities.

Table 9
Regional Economic Impact of the Port Industry, 1987 vs 1993

Sector	1987 Jobs	1993 Jobs	% Change
Physical Handling	24,500	18,510	(24.4)
Inland Transportation	20,000	13,700	(31.5)
Trade Related Services	21,000	18,120	(13.7)
Wholesaling & Warehousing	40,000	40,000	0.0
Government	2,000	2,040	2.0
Total Direct	107,500	92,370	(14.0)
Indirect & Induced	73,300	74,130	11.3
TOTAL	180,800	166,500	(7.9)

The decrease in petroleum imports was partly responsible for the 31.5 percent decline in inland transportation jobs; however, structural changes in both the industry and the economy (e.g. deregulation of the trucking sector and increases in intermodal rail movements) also contributed to this fall.

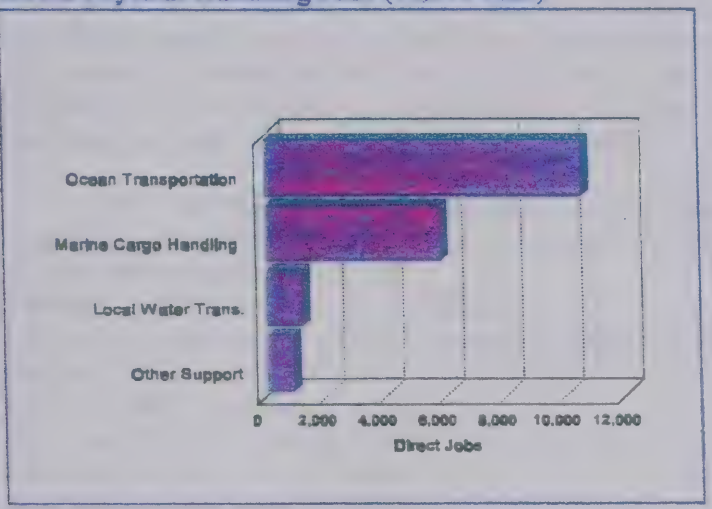
The trade-related services component dropped by 13.7 percent due to the drop in the volume of cargo handled at the port during this period. In addition, the severe regional recession of 1989-1992, during which overall regional employment declined by 8.6 percent, or 657,000 jobs, also impacted this segment of the industry.

Finally, although the direct component of the industry was smaller than in 1987, the number of indirect and induced jobs grew by 11.3 percent. This reflects a total change of 17.6 percent which reflects both productivity increases in the port industry and changes in the structure of the regional economy. In other words, in 1993, the port industry produced more services per worker than it did in 1987. In addition, both the industry and its workers spent more within the regional economy than they did in 1987.

SECTION III: DESCRIPTIVE COMPONENTS OF THE PORT INDUSTRY

The firms which make up the port industry can be divided into five major segments: physical handling, inland transportation, warehousing and distribution services, trade related services, and government agencies. These major segments can, in turn, be broken down into a number of sub-components, or industry sectors as described below.

Chart 4
Direct Physical Handling Jobs (18,510 Jobs)



The Physical Handling segment of the industry includes those firms which directly move cargo over the water, and handle cargo at the port facilities. Included in this sector are firms involved in ocean transportation such as steamship lines, shipbrokers and charters; firms involved in local water transportation such as tug and towboat operators and barge lines; stevedores and longshoremen; and firms and individuals who involved in specialized activities at the port such as samplers, surveyors and weighers. In addition the local harbor pilots are included in this segment of the port industry. The direct job impact of the physical handling segment of the port industry is shown in Chart 4 above. This segment generated just over $3.4 billion in direct sales and $881 million in direct wages.

Table 10
Direct Impacts of the Inland Transportation Segment of the Port Industry

Sector	Employment	Pct.	Wages ($ Millions)	Pct.	Sales ($ Millions)	Pct.
Trucking	11,420	83.6	341.7	81.9	1,153.9	85.8
Railroads	2,240	16.4	75.1	18.0	187.1	13.9
Pipelines	7	0.0	0.3	0.1	3.1	0.2
Total	13,667	100.0	417.1	100.0	1,344.1	100.0

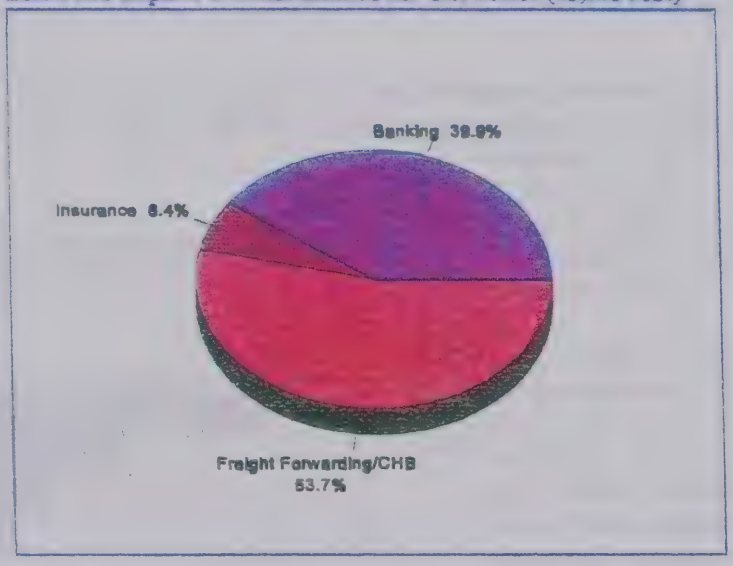
The inland transportation segment of the port industry is comprised of firms involved in moving cargo by land between the port and an inland destination within North America. Barge companies are not included in this industry segment, but are a part of the physical handling component of the port industry. Inland transportation firms are primarily engaged in the trucking, railroad and pipeline industries. Table 10, on page 15, lists the direct economic impact for these industry sectors.

The Wholesaling and Warehousing Services segment of the industry includes those firms which are engaged in storage and allocation services for goods moving over the docks and wharves of the port. Included in this segment are companies which operate general warehouses, refrigerated warehouses, bonded warehouses, tank farms, grain elevators, etc. In addition firms engaged in wholesaling and trading activities are included in this industry segment. The warehousing and distribution services segment of the port industry produces approximately 40,000 direct full time equivalent jobs in the region, generating over $1.6 billion in direct wages from sales of $3.8 billion.

The trade related services segment of the port industry consists of freight forwarding businesses, customs house brokers, bankers involved in financing both trade and investment in vessels, and marine cargo and hull insurance companies. Firms involved in trade related services generated $2,310 million in regional sales in 1993, generating over 18,117 direct jobs with almost $784 million in wages. Chart 5 shows the relative contribution of the three trade related services sectors.

Chart 5

Direct Job Impacts of Trade Related Services Sector (18,120 Jobs)



The government segment of the port industry includes those federal, state and local government activities which directly support the movement of waterborne cargo through the port. The major components of this segment are the U.S. Customs Service, the U.S. Army Corps of Engineers, the Port Authority of New York and New Jersey, and the Waterfront Commission of New York Harbor. In sum, the government segment provides $274 million in services to cargo moving through the port, and generates about 2,000 jobs with $91 million in wages.

SECTION IV: ECONOMIC IMPACT OF PORT-DEPENDENT INDUSTRIES

In addition to the industries that are directly involved in moving cargo through the port, there are other industries that generate regional economic impacts. These are industries that are significantly dependent on direct access to the port and waterborne shipping. Raw materials handled through the port are critical inputs for these industries, and without the port, these firms could not be located in the region. Examples of these firms include: petroleum refineries, sugar cane refining, electric utilities, and scrap and waste materials processing. Table 11 below shows the economic impact of these industries in the regional economy.

Table 11
Economic Impact of Port Dependent Industries

Impact	Jobs	Pct.	Wages ($ Million)	Pct.	Sales ($ Million)	Pct.	Taxes ($ Million)	Pct.
Direct	17,340	53.7	820	56.6	7,300	73.0	68.0	56.7
Indirect	14,970	46.3	630	43.4	2,700	27.0	52.0	43.3
Total	32,310	100.0	1,450	100.0	10,000	100.0	120.0	100.0

Port dependent industries directly employ 17,340 workers in the region, generating a total payroll of $820 million, and sales of $7.3 billion. Through the multiplier process, port dependent industries generate 32,310 total jobs, $1.4 billion in wages, and $10.0 billion in regional economic activity.

Chart 6
Direct Job Impacts in Port Dependent Industries (32,310 Jobs)

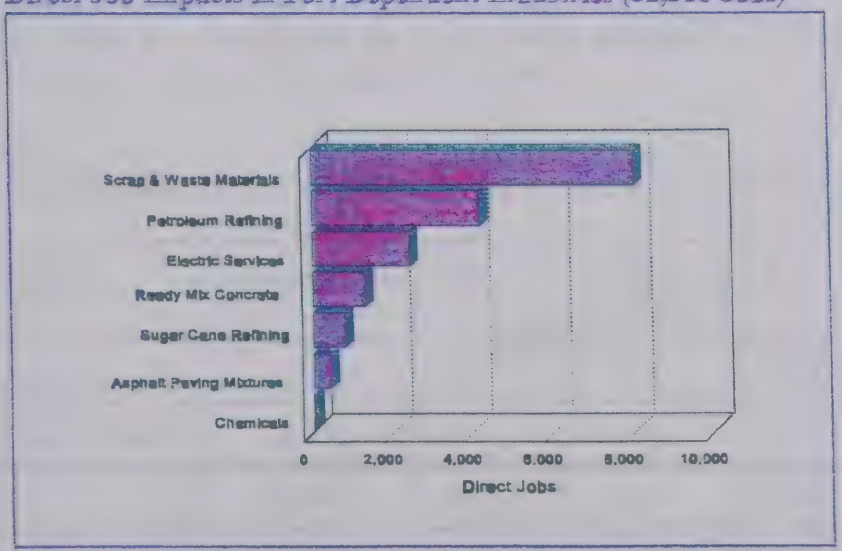


Chart 6 shows the distribution of direct jobs in port dependent industries. The scrap and waste materials industry is the largest in the region, followed by petroleum refining and electric utilities, with the chemical industry generating the least regional jobs.

SECTION V: ECONOMIC IMPACT OF PORT INVESTMENT

The impact of the Port Industry is not limited to current operations; the port must also gear up for future growth and changing technologies which require heavy investment in facility construction and equipment. As such, there are two levels at which impact should be measured. One is the economic impact of port operations; the other is the economic impact of port investment. So far, our analysis has focused on the economic impact of port operations. This section focuses on the impact of port investments by the Port Authority and tenants at Port Authority facilities.

Port Authority Facility Investments (1987-1994)

Analysis of Port Authority capital investment showed that over the 8-year period, 1987-1994, the Port Authority invested more than $507 million in marine facilities to improve the competitiveness of the Port of New York-New Jersey. These investments have improved access to the port, enhanced basic infrastructure, and upgraded terminal facilities.

As shown in Table 12 below, capital investments in the Port of New York-New Jersey by the Port Authority during the 1987-1994 period generated or supported a total of 10,180 jobs, $1.1 billion in sales, and $384 million in wages. Construction activity accounted for the majority of the impacts generated, about 63 percent of jobs. Non-construction jobs are mostly supporting jobs comprised of engineering, finance, Port Authority labor and benefits. On an annual basis, Port Authority capital investments over the 8-year period generated 1,272 jobs, $134.5 million in sales, and $48 million in wages in the regional economy.

Table 12
Economic Impact of Port Authority Capital Investments in the Port

Impact	Employment	Pct.	Wages ($ Millions)	Pct.	Sales ($ Millions)	Pct.
Construction	6,610	64.9	244	63.5	708	65.8
Non-Construction[s]	3,570	35.1	140	36.5	368	34.2
Total	10,180	100.0	384	100.0	1,076	100.0
Average	1,272		48		135	

[s] Non-Construction includes engineering, finance, Port Authority labor, and benefits.

Tenant Capital Investments

Exact figures for capital investments in port facilities by tenants during the 1987-1994 period were not available. Nevertheless, port tenants made significant investments in marine facilities. For example, during the 1991-1994 Port Authority capital plan window, it is estimated that tenants made investments of $40 million in port facilities. These investments were estimated to have generated a total of 700 jobs during the five-year period, $68 million in sales, and $23 million in wages. On an annual basis, this equates to 140 jobs, $13.6 million in sales, and $4.6 million in wages.

SECTION VI: SUMMARY OF PORT-RELATED IMPACTS

This section presents the total economic impacts of the Port of New York-New Jersey. The port directly stimulated 110,552 jobs, over $18 billion in sales revenues, $4.6 billion in wages, and $0.38 billion in state and local taxes in the 17-county New York-New Jersey metropolitan region during 1993. The total impacts across all three categories below are not additive because of the problem of double-counting among the indirect impacts. When the double-counting is eliminated, the Port of New York-New Jersey was responsible for a total of 193,390 jobs, over $28 billion in sales revenues, $7.5 billion in wages, and $0.6 billion in state and local taxes.

Table 13
Overall Impact of the Port Industry by Category

Category	Employment	Wages ($ Millions)	Sales ($ Millions)	Taxes ($ Millions)
Port Industry				
Direct	92,320	3,780	10,960	312
Total	166,500	6,220	19,024	514
Port Dependent Industries				
Direct	17,340	820	7,300	68
Total	32,310	1,450	10,000	120
Port Capital Spending[9]				
Direct	890	36	89	N/A
Total	1,410	53	148	N/A
Total Direct	110,550	4,636	18,349	380
Overall Total[10]	193,390	7,500	28,350	615

Overall activities linked to the port accounted for 3.3 percent of the Gross Regional Product, and direct jobs generated represented about 1.6 percent of total regional employment. Table 13 above lists both the direct and total impacts by category.

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9 Annualized data. Includes both Port Authority and tenant spending.

10 Adjusted to exclude all double-counting in the indirect impacts. Many of the indirect impacts accounted for as a part of the port industry are direct impacts of the port dependent industries, and vice versa.

SECTION VII: NON-QUANTIFIED BENEFITS AND COSTS OF THE PORT

Thus far, the analysis has focused on the regional economic impact of the port industry. The regional economic impact analysis presented in the preceding sections assesses the incremental changes in certain economic indicators -- jobs, wages, sales and taxes -- arising from the business transactions of the port industry. In addition to this, there are a number of effects that can be attributed to the port itself which go far beyond the value of the port to the Port Authority or to any individual person or firm, but accrue to the region as a whole.

Regional Cost/Benefit Analysis is a methodological tool employed by the Port Authority to determine, measure and monetize numerous benefits and costs associated with an industry such as the port. Regional effects, for the most part, cannot be attributed to a single individual or firm, but are the result of the entire port. For example, the existence of the port in the region allows raw materials, such as fuel oil, to be shipped into the region in bulk by water. This may reduce the need for truck trips utilizing the regional highway system to deliver these same products. Reduced regional air pollution and reduced automobile related accidents may be the beneficial result of this.

Section VII will examine the other effects (cost-benefit attributes) that accrue to the region due to the existence of the port itself. Although an actual cost/benefit analysis will not be presented at this time, the attributes will be examined qualitatively starting with a discussion of the social costs of the port to the region. Next, the benefit attributes will be examined, starting with the regional economic development benefits. This discussion will be followed by an examination of transportation benefits, and finally environmental benefits to the region.

Social Costs of the Regional Port System

Although the port of New York-New Jersey has a number of positive impacts, such as the creation of jobs, wages and taxes, these do not come without costs to some regional stakeholders. These effects in themselves may not be large, and are definitely not as large as the offsetting benefits; however, they must be taken into account in any discussion of the qualitative effects of the port on the region.

As a whole, the port is environmentally benign. In fact, many ports, especially those on the west coast, are havens for wildlife. If the port were not to exist, most of its negative effects would still exist in another context, and some of the positive impacts would not exist at all. There are, however, some regional environmental costs which must be considered. There is a general perception of the port as being a major contributor to regional water pollution; however, in general, the port is fairly benign to the water environment. Most pollutants, such as fecal chloroform, chlorine, potassium and nitrogen compounds, result from waste-water systems or farm operations. Others, such as silt, are natural, and petrochemicals and heavy metal contaminants come mainly from

industrial operations. Since the enactment of the Oil Pollution Control Act of 1990 (OPA - 90) the port industry has had to contain and eliminate pollution caused by runoff from the facilities themselves. In addition, international regulations have virtually eliminated the discharge of pollutants from vessels in the harbor. While the existence of the port can lead to local oil and chemical spills from tankers, similar pollution would likely occur if these materials were to be brought into the region by truck or rail. Other specific effects such as increased solid waste, especially waste that is generated from ships and international cargo (considered by law to be contaminated) should be mentioned in this context.

Other opportunity costs of the port are economic in nature. The use of waterfront space by port facilities, especially in urban areas such as Manhattan, consumes land which may have better economic uses or could provide higher tax revenues to the municipality. The reuse of this space for other activities, such as commercial, residential or recreational development must be considered if these negative effects are to be reduced. In addition, the port may affect various segments of the society differently. For example, although the port has a positive impact on those who are employed there (i.e. longshoremen) it may be a detriment to residents of nearby neighborhoods, i.e., Red Hook Brooklyn, due to increased congestion, air pollution and noise.

Economic Development Effects

The mission of the Port Authority reflects the agency's desire to improve the economy of the New York metropolitan region. This desire is reflected in the regional cost/benefit analysis by the relative weight placed on economic development benefits. These benefits may be derived by consumers, producers, or government, and can be in one sector of the economy, or may be felt throughout the region.

The port is a major component of the regional economy and the regional infrastructure network, and as such, its existence produces a number of positive effects. These include increased business opportunities and improvements to the regional business environment, improved access to markets and generally lower consumer costs than would exist if it were not for the port.

One of the Port Authority's main goals in constructing and operating facilities is to attract new enterprises to the region. The regional port network is just such a facility. As was mentioned in Section III above, many businesses are located in this region specifically because of the access to waterborne transportation. In addition, many other businesses have located in the region since the port provides convenient links to suppliers and customers not only domestically, but throughout the world. This may, in turn, lead additional businesses to locate in the region, or to increase production at regional facilities. Other firms have located directly on port property to take advantage of specific benefits such as the Foreign Trade Zones.

In addition to lowering direct costs to regional businesses, the regional port system lowers costs to consumers as well. If cargo could not be imported through the Port of New York-New Jersey, but rather had to come via our nearest competitor, Philadelphia, the per container cost of imported goods would rise by approximately $250.00. This may not seem like much; however, a recent study by the Port of Philadelphia which examined the cost of imported alcoholic beverages found that moving this cargo to Philadelphia via the Port of New York-New Jersey added one percent to the final retail price of the average bottle of imported wine and liquor.[11] If a similar one percent "surcharge" were to be placed on all imported containerized cargo entering the New York-New Jersey region via the port, the cost to consumers would be approximately $160 million.

Transportation Effects

Many of the facilities owned and operated by the Port Authority of New York-New Jersey create sizable direct benefits to the regional transportation system. In addition to these direct benefits, many improvements to the transportation system will also result in indirect improvements in such other areas such as air and water pollution and regional productivity.

The port is a major component of the regional transportation system and a full analysis of its effects would undoubtedly highlight numerous positive impacts for all users. In general qualitative terms, the major transportation benefit of the port is a reduction in congestion on the regional highway network. If the Port of New York-New Jersey were not to exist at all, the citizens of this region would still need to be supplied with goods, not only from abroad, but from other regions of the country. Undoubtedly, many of these products would be brought in by air through the regional airport system; however, many products, especially bulky raw materials such as cement, sand, sugar and most importantly petroleum products and crude oil, would need to be brought into the region either by truck or rail. This would lead to a tremendous increase in the number of trucks on the regional highway network, which would in turn, lead to increased congestion. A specific example can illustrate this point. In 1993, almost 5 million metric tons of sand and gravel were handled over the docks of the port. If this cargo, which represents just four percent of the total cargo handled, had to be moved into and through the region by truck instead of by barge, an additional 278,000 annual truck trips (one way) would need to be made. The additional truck, rail and air traffic that would be needed if a significant percent of 116.7 million metric tons of cargo now handled by the port had to move through this region without water transportation, would undoubtedly be immense. Congested highways have many negative social impacts, ranging from increasing delays for individuals and firms using the system, to increases in air pollution, and higher maintenance costs.

The reduced highway congestion which can be attributed to the port leads to one of its main transportation benefits -- time savings. When congestion on the regional transportation system is reduced, so are travel times. These reductions in times allow both motorists and trucking companies

[11] Testimony to the House Merchant Marine and Fisheries Committee, January 1993.

to better utilize both work and leisure time. a direct benefit to all users of the regional transportation system.

Environmental Effects

Although there is a general perception that the port is a major source of pollution, most direct water pollution sources have been eliminated or at least reduced in recent years. Additionally, regional dredging operations may actually lead to a generalized cleaning of the harbor, as contaminated sediments are removed from the environment.

Even if the port does not improve the quality of the local waterways, it may improve the habitat for local aquarian species. Throughout the United States, port facilities are quickly being overrun by wildlife. This is especially true on the west coast. The port does not directly harm terrestrial wildlife, and may actually provide an enhanced habitat for underwater life by providing areas between pilings for fish spawning, and for aquatic vegetation and bi-valves to grow.

Finally, as a result of the reduction in local truck traffic which may be caused by the port, there may be a concurrent reduction in regional air pollution. The port is a major industrial enterprise, and its cranes, yard equipment and the ships themselves create some level of air pollution. This pollution, however, must be compared, to the negative effects on air pollution that would occur if all of the commodities currently moved into and out of the region by water were to be moved by air, rail or truck.

APPENDIX I.
METHODOLOGY AND ASSUMPTIONS

The Economic Impact of the Port Industry begins with the definition of the industry to be studied. For the purpose of this analysis, the port industry is defined as:

1) Those firms providing the major products and services involved in moving cargo through the Port of New York-New Jersey and between the Port and a domestic inland destination/origin.

2) The port industry only includes firms providing services to cargo. (The passenger sector was not included in this analysis.)

3) Only firms located in the 17-county region were included.

The methodology that was used to determine the regional economic impact of this industry is described below.

DIRECT IMPACTS (JOBS)

The direct impacts include all employees in firms involved in the movement of waterborne cargo, whose jobs are directly related to this activity. These are the people who can actually be counted. Direct jobs were determined for each of 13 specific industries:

- Ocean Transportation
- Marine Cargo Handling
- Local Water
- Other Support
- Trucking and Warehousing
- Inland Rail
- Pipelines
- Wholesaling
- Banking
- Insurance
- Freight Forwarding/Customs House Brokerage
- Federal Government
- State and Local Government

Ocean Transportation: Direct jobs were obtained from the United States Department of Labor Employment Series (ES202) report. This report lists total insured employees in the region. (Self employed and non-insured individuals are not included; however, there are relatively few people not employed by major firms working in this sector).

Marine Cargo Handling: Direct jobs were obtained from the ES202 report. There are virtually no self-employed individuals in this sector. Most workers are ILA longshoremen.

Local Water Transportation: Direct jobs were obtained from the ES202 report. There are virtually no self-employed individuals in this sector. Most of these employees work for firms in the towing and barge industry.

Other Support Services: Direct jobs were obtained from the ES202 report and organizational membership rosters.

Trucking/Rail/Pipelines: Direct jobs for each of these three sectors were obtained in the same manner, and are all derived from the value of cargo moved as per the following formula:

(((87BEA*F&D)*IHM)*RPC)/OER

where:
BEA = Bureau of Economic Analysis
87BEA = % of a commodity's total value added in 1987 as developed by the Bur. of Econ. Anal.
F&D = is the total value of Foreign and Domestic Cargo
IHM = the percent of cargo handled by each mode (Rail/Truck/Pipe)
RPC = Regional Purchasing Coefficient from the Port Authority's I/O Model
OER = Output per Employee Ratio from the Port Authority's I/O Model

Step by step, the following calculations were performed:

☞ Foreign cargo statistics for 1993 were obtained from E&P's Strategic Information Division. These figures are from the US Department of Commerce, Bureau of the Census, with an estimate of intransit added by the Port Department (Intransit cargo is that cargo which is handled in the Port but which clears customs in another Customs District). Data includes both tonnage (metric tons) and value.

☞ The Port of Albany is included in the customs district for New York, therefore, this cargo must be removed from the total. This was done by estimating the percentage of total cargo by commodity and by direction (export or import) handled in Albany. This estimate came from the 1992 Waterborne Commerce Statistics of the United States, developed by the US Army, Corps of Engineers.

☞ Domestic cargo statistics were developed by commodity type, by reach (handling location) and by direction (inbound or outbound) for all reaches in the Port District. This data came from the 1992 Waterborne Commerce Statistics of the United States, developed by the US Army, Corps of Engineers. Since this data is given in short tons, it was converted into metric tons using the ratio (2000 lbs/2204.6 lbs).

☞ An estimate of 1993 domestic cargo tonnage was developed by reducing the 1992 data by 9.1 percent. This factor was based on the average annual percent change (geometric average) in cargo volumes for all reaches between 1990 and 1992.

☞ The value of international cargo was obtained from the U.S. Department of Commerce, Bureau of the Census, and the Port Department in the same manner as tonnage.

☞ The value of domestic cargo was estimated by multiplying domestic tonnage by the international value/ton.

☞ Each commodity was assigned a Port Authority Input-Output (PAIO) code from the original 89 sector port model.

☞ Commodity values were compiled by PAIO code for both imports/inbound and exports/outbound.

☞ A bridge between PAIO code and National Accounts Input-Output (NAIO) code was created. Commodity values were evenly distributed by NAIO code in each PAIO sector.

☞ The total value in each NAIO sector was multiplied by the inland transportation modal split, resulting in the total value handled by mode and by direction. This modal percentage comes from the modal distribution associated with the original port model.

☞ The value of cargo by each mode was multiplied by the BEA margin, or the percent of a commodity's value associated with each form of inland transportation. This gives total sales by mode, by commodity and by direction.

☞ Sales within the region were calculated by multiplying "sales by mode" with the Regional Purchase Coefficient (RPC) from the Port Authority's I/O model.

☞ Employment was calculated for each mode by dividing sales by mode with the Output/Employee Ratio.

☞ Total Direct Employment in each sector was calculated by summing employment for all commodities.

Wholesaling: Direct jobs in wholesaling were calculated in the same manner as that for the Trucking, Rail and Pipeline sectors with the following adjustments:

1) Intransit cargo, high value goods (artworks, precious stones, jewelry) and live animals were removed from the analysis.

2) The total value of the remaining cargo was reduced to 67.9 percent. This is the estimate of total cargo which either originates from or is destined to the region. The export value was reduced by 40 percent to account for the fact that not all export cargo goes through the distribution channel.

Banking/Insurance: Direct jobs in these sectors are based on a survey of the industries which was done in 1987. This survey found that 5.2 percent of regional banking jobs, and 2.8 percent of regional insurance jobs were related to the handling of marine cargo. Direct jobs were

calculated by multiplying total jobs from the ES202 report by the above percentages.

Freight Forwarding/Customs House Brokerage: The same 1987 survey showed that 46.6 percent of jobs in this sector were related to the handling of marine cargo. Again, direct jobs were found by multiplying total jobs from the ES202 report by 46.6 percent.

Federal Government: The following government departments were surveyed telephonically to determine the number of employees whose jobs were dependent on waterborne cargo:

- US Customs Service
- US Coast Guard
- US Army Corps of Engineers
- US Dept. of Trans. Maritime Admin. (MARAD)
- Environmental Protection Agy.
- Food and Drug Administration
- Other (inc. Fish and Wildlife, DEA, ATF)

State and Local Government: The Waterfront Commission and several departments within the City of New York were surveyed telephonically to determine the number of employees whose jobs were dependent on waterborne cargo. In addition, it was estimated that 10 jobs in various State and City agencies were also dependent on waterborne commerce. Direct Port Authority jobs were obtained by adding an estimate of related staff department jobs (approximately 5 percent of the total staff jobs) to the headcount of the Port Department.

DIRECT IMPACTS (SALES)

For all sectors, direct sales were estimated as the product of direct jobs and the Output/Employee ratios from the Port Authority I/O Model.

DIRECT IMPACTS (WAGES)

For all sectors, direct wages are estimated as a product of average regional wages from the ES202 report and direct jobs. The only exception to this is in the ocean transportation sector where $49,038 was used. This is the average of the national wages for the deep sea foreign, deep sea domestic, coastwise and intercostal sectors. ES202 wages were not utilized because they did not seem to reflect reality in the industry.

INDIRECT IMPACTS (JOBS)

Step 1:

Direct Output Impacts were consolidated into NAIO sectors. In this case, there were 10 distinct sectors:

▸	650100 -	Rail Transportation	▸	690100 -	Wholesale Trades
▸	650300 -	Trucking/Warehousing	▸	700100 -	Banking
▸	650400 -	Waterborne Transport	▸	700400 -	Insurance
▸	650600 -	Pipelines	▸	780100 -	Federal Government
▸	650701 -	Freight Forwarding/CHB	▸	790300 -	Local Government

Step 2:

Each of the sectors was loaded into the I-O model and the total impacts were obtained

Step 3:

A cross tabulation of total impacts (by jobs) was compiled. The jobs on the diagonal (direct jobs by sector) were removed for all but the Federal and State Government sectors (these are not calculated by the model). Crosstabulation percents were calculated based on total jobs.

Step 4:

The crosstabulation matrix was used to eliminate double counting. The direct impact vector was determined outside of the model. Logically, if all direct impacts in a sector are included in this vector, all indirect impacts which may show up in the second round run (impacts which result from spending by the companies and individuals directly involved in waterborne transportation) are already included. Based on further discussion of the industries, many of these impacts were removed from the analysis. In this case:

- All Waterborne Transportation impacts relating to the use of this service by any of the other sectors. This was removed because the direct employment figures come from ES202 and should already reflect all regional employment in this sector.

- Banking impacts related to the use of this service by Freight Forwarders and Customs House Brokers was removed from the totals since banking jobs are calculated based on survey research and should already include all bank impacts related to international waterborne trade.

- Trucking, wholesale, rail and pipeline impacts related to the use of these services by Freight Forwarders/CHB. These impacts were removed from the totals since trucking, rail, pipeline and wholesaling impacts are based on BEA margins applied to total cargo values and should already be included for situations where the Freight Forwarder is either the shipper, or is hiring the inland transportation.

- Impacts on the trucking, rail and pipeline sectors relating to purchases in the wholesale industry were removed

from the totals. The direct impacts for these sectors are based on margins and should include all related costs. These services are often purchased by a wholesaler for the cargo if in-house resources are not available.

- Impacts on the Freight Forwarding banking and insurance sectors resulting from demand by the Waterborne Transportation sectors were removed from the totals since direct impacts for these three sectors were the result of a survey which took into account all demands by the waterborne transportation sector.

- Impacts resulting from cross-purchasers between trucking and rail sectors were removed since the purchasers are all related to the same cargo; the impacts of the cargo are captured in either truck or in rail.

- Impacts on the trucking, rail and pipeline sectors resulting from demand by the Waterborne Transportation sector were also removed from the totals. A large percentage of this will be the result of contracts with steamship lines or trucking for the account of a vessel operator which controls cargo - i.e. a gravel barge operator.

Step 5:

Impacts for the removed sectors were summed and then subtracted from the Total Impact Numbers, leaving a Net Total Impact.

Step 6:

Direct impacts were removed from the Net Total Impact numbers, resulting in the final calculation of Indirect Impacts.

INDIRECT IMPACTS (WAGES)

The preceding seven steps for indirect job impacts were repeated for wages. The same cross sectoral purchases were excluded from the totals.

INDIRECT IMPACTS (SALES)

The preceding seven steps for indirect job impacts were repeated for sales. The same cross sectoral purchases were excluded from the totals.

TAXES

State and Local taxes were calculated using Economic Impact Division's tax model.

APPENDIX II
THE PORT AUTHORITY INPUT-OUTPUT MODEL

Input-output models, in general, and the Port Authority's Model, in particular, focuses on the interrelationships or flows of products between industries. The Port Authority's Regional Input-Output Model was first developed in 1978 and is continually updated to reflect changes in the regional economy as well as to integrate the results of regional studies, surveys and current regional data.

The mathematics of this techniques are designed to capture the "ripple effects" of changes in an economy, in this case the economy of the 17-county New York-New Jersey region. These ripple effects can be illustrated as follows: If industry "A" increases its production by $100 million, it purchases additional quantities of goods and services from other industries. To meet "A's" needs, each of "A's" supplying industries increase their production, which, in turn, requires additional quantities of their respective inputs. The producers of these inputs increase their output and so on resulting in a domino effect throughout the economy.

The Port Authority's Regional Input-Output Model calculates the total economy-wide sales, employment, personal and business income impacts resulting from the spending of industries or projects in the region. In addition, personal income and retail/sales tax collection impacts are also estimated for the states of New York and New Jersey as well as for New York City.

At the heart of the Port Authority's Regional Input-Output Model is a matrix of inter-industry flows developed from the latest national input-output data assembled by the Bureau of Economic Analysis of the United States Department of Commerce. This matrix represents the transactions of 538 industrial, governmental and consumer sectors of the national economy by displaying how each sector in economy uses the output of other sectors in producing its own product - and to what sectors its product is eventually sold.

In order to develop the national matrix of inter-industry flows into the Port Authority's Regional Input-Output Model, coefficients are developed which reflect the purchasing patterns of the 17-county regional economy by indicating what share of a product consumed in the region is actually produced within the region. These Regional Purchase Coefficients, developed by the Port Authority, are based on data from the New York and New Jersey State Bureaus of Labor Statistics, Regional Commodity Flow Surveys, Commerce Department export statistics and other information.

The databases and interactive programs required to run the regional input-output model are stored on the Port Authority's computers.

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